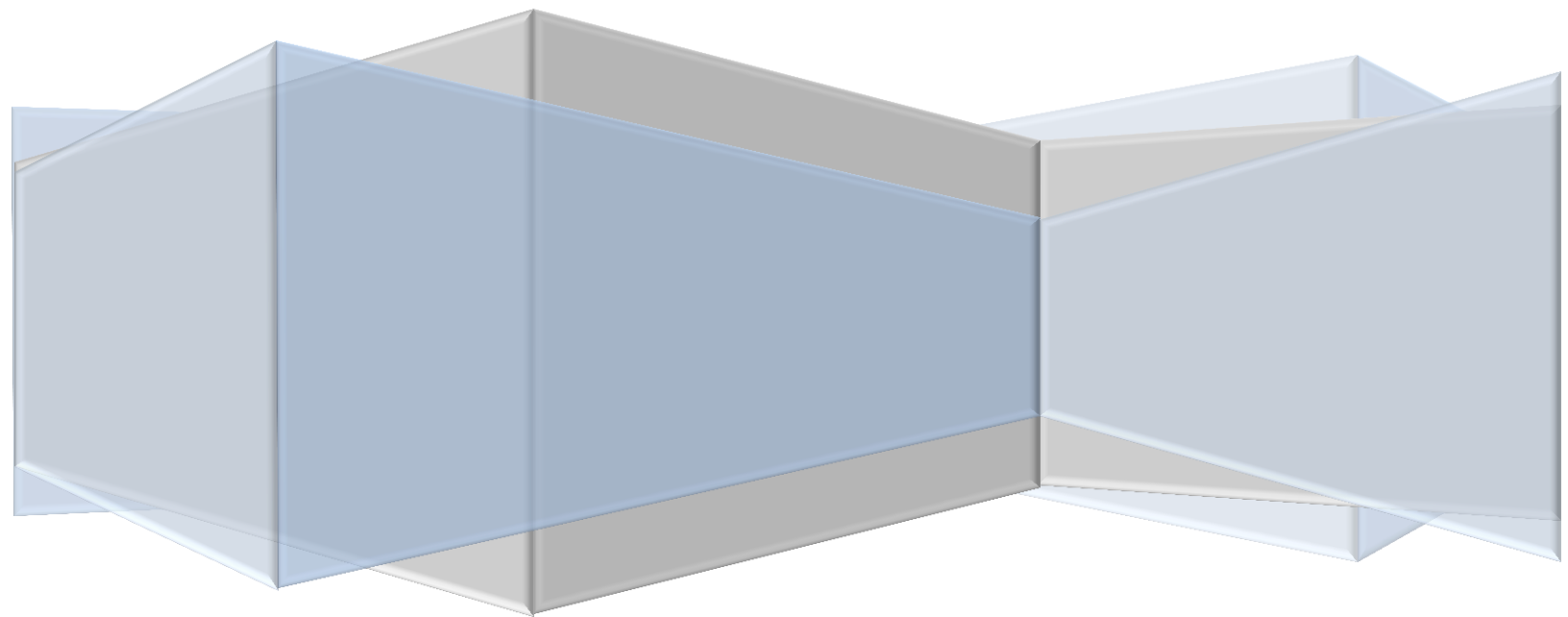


# Eric Anderson

## Technical Report 1

### Existing Lighting Conditions



## Executive Summary:

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The contents of Technical Report One include the evaluation of the lighting design and basic features of The Web Shop: The Lighting Quotient's Headquarters. It is comprised of a two story office building with one basement level, as well as a factory floor, where Elliptipar and Tambient product assembly takes place. The building was originally built in 1906 as a textile mill. It was later purchased, restored, and renovated by Sylvan R. Shemitz, the founder of Elliptipar.

The spaces that will be studied in this report are the first floor open plan office for engineering, the training/meeting room, the main lobby, and the main entrance and façade. The features of each space including existing lighting will be discussed in detail. Design criteria for each space will be presented, and the space will be critiqued accordingly based on the qualitative analysis and computer calculations.

This building uses primarily Elliptipar indirect lighting solutions in all spaces to showcase their products in real situations, in particular the office areas. The design coincides with typical office plans, yet there are touches of architectural aesthetic throughout the building. These aesthetics include the preserved woodwork from the original textile mill.

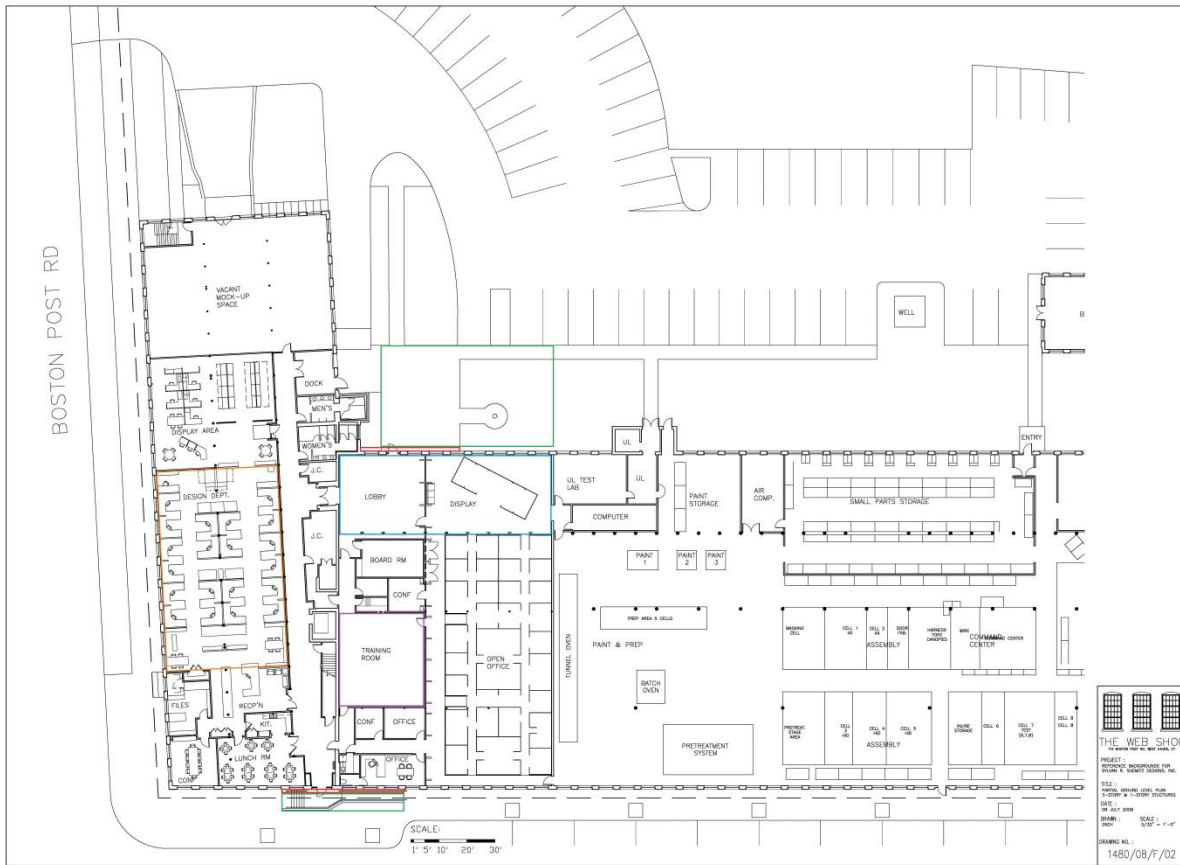
Though the lighting designs are sufficient, there is still room for improvement with efficiency. In the following document, I will attempt to highlight the design features and criteria as well as critique the lighting design in an effort to establish a baseline for further improvement.

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# General Building Statistics:



Work Space – Open Plan Office – shown to the left in orange

Special Purpose Space – Training and Meeting Room – shown below in purple

Circulation Space – Lobby – shown above in blue

Outdoor Space – Façade – shown above in red

# Work Space: Existing Conditions

---

## Description:

This open office is the smaller of the two offices at 71' x 44'. However with 13' walls and exposed wood beams and columns, it is the more aesthetically pleasing of the two. Natural daylighting comes from the North facing wall. The cubicles are used primarily for VDT usage.

## Materials:

### Floor:

Dark blue carpet on raised floor.

Reflectance: 0.2 (assumed)

### Ceiling:

White acoustical tile.

Reflectance: 0.8 (assumed)

### Accents:

Red paint. Semi-gloss.

Reflectance: 0.25 (assumed)

### Walls:

White paint on gypsum wall board.

Reflectance: 0.5 (assumed)

### Woodwork:

Beams and columns.

Reflectance: 0.5 (assumed)

### Furniture:

Cubicles.

Reflectance: 0.5 (assumed)

### Wall Hangings:

Paintings and white boards.

Reflectance: 0.5 (assumed)

### Glass:

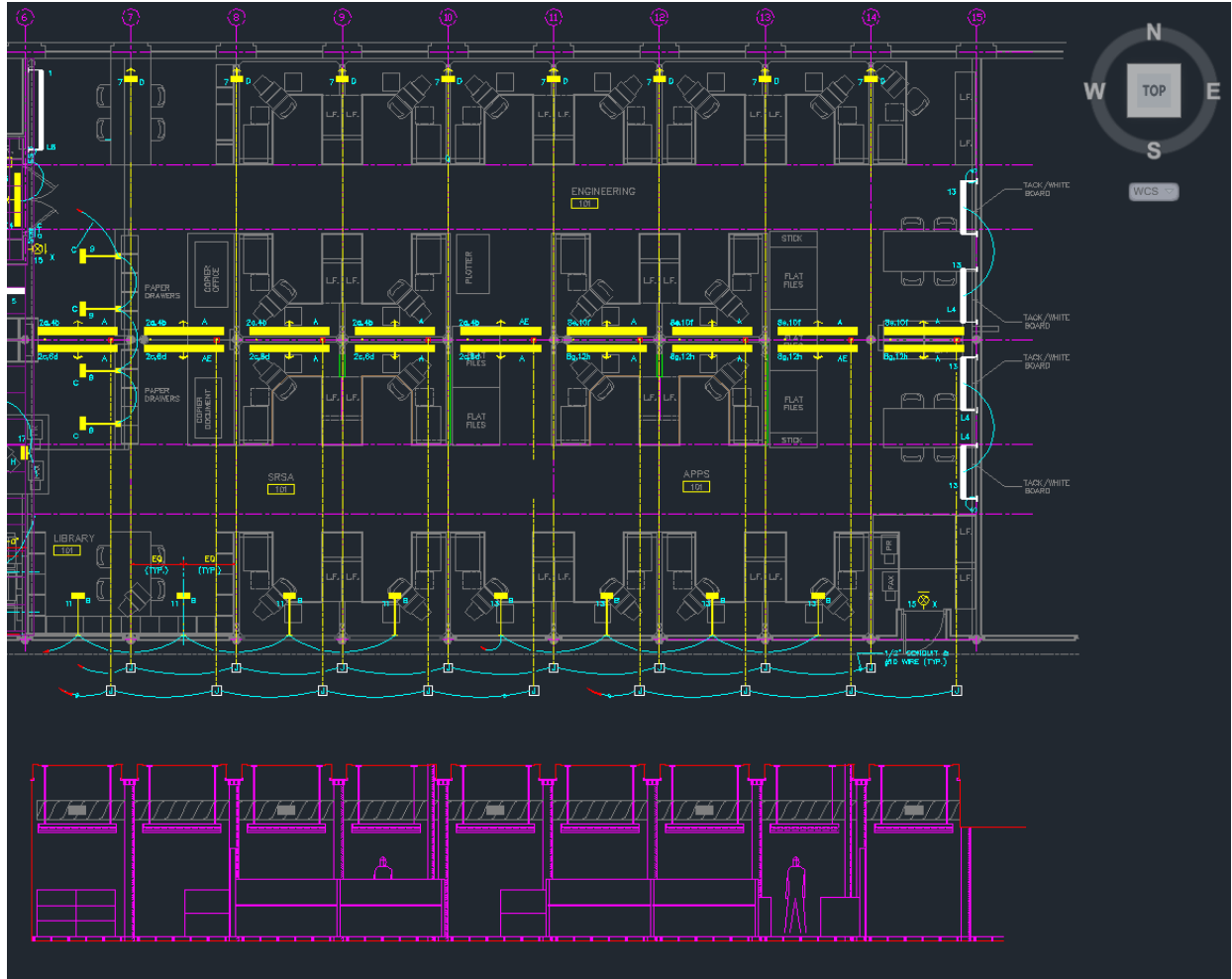
Windows.

Reflectance: 0.15

Transmittance: 0.85

# Work Space: Existing Conditions

## Lighting Plan and Elevation:



# Work Space: Existing Conditions

Photographs:



# Work Space: Existing Conditions

---

## Lighting Equipment:

General ambient light in the work space is provided indirectly by 18 custom F113 fixtures, which illuminate the ceiling. This is supplemented to some degree by wall grazing. The north wall is grazed between the large windows by tungsten halogen T099 fixtures. The south wall, which has no windows, is grazed by metal halide M101 fixtures. The east wall has 4 white boards, which are highlighted by linear fluorescent F101 fixtures. The west end of the space has a 7 foot partition wall that is grazed with artwork by 4 compact fluorescent F111 fixtures.

## Schedule:

Lighting	Name	Mounting	Type	Qty.	Lamps Ea.	Watts Ea.	Watts Tot.
Uplight	Elliptipar F113	Pendant	A	18	6-Twin Tube Flu.	351	6348
Wall Wash	Elliptipar M101	Cantilever	B	8	1-Ceramic MH	195	1560
Wall Wash	Elliptipar F111	Cantilever	C	4	1-Qaud Tube CFL	34	136
Wall Wash	Elliptipar T099	Wall Mount	D	8	1-Tungsten Halo.	50	400
Wall Wash	Elliptipar F101	Cantilever	L4	4	1-T8 Linear Flu.	34	136



# Work Space: Design Consideration

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## Design Criteria:

Open plan office - Intensive VDT use, Hand written tasks, Printed tasks

### Illuminance Values

- Horizontal - 30 fc
- Vertical - 5 fc

### Direct Glare- Very Important

- Direct glare can cause visual discomfort and interfere with visibility of the occupants. Its main causes are from luminaire placement and natural light coming in through windows. Because reading and writing will be two tasks being performed by the occupants, it is crucial to control this problem in order for work to be done properly. Considerations to prevent this lie in use of indirect instead of direct light sources, luminaire placement, and placement of seating around fenestrations.

### Reflected Glare- Very Important

- Reflected glare can be caused by light refracting off of shiny or glossy surfaces such as magazines. Veiling reflections from such surfaces can cause visual discomfort and reduce contrast on the surface. It is very likely that the occupants will be reading text glossy paper so reflected glare should not be ignored. This problem can be solved in much the same way direct glare can.

### Luminances of Surfaces- Very Important

- Luminance values should be uniform on all surfaces; including floor, wall, ceiling, and work plane in order to reduce visual clutter and distractions. However, a slightly higher luminance value may be desired on work surfaces in order to direct focus to the work of the occupants.

### Light Distribution on Task Plane (Uniformity) - Very Important

- Uniformity on the task plane is important for visual clarity while performing tasks such as reading and writing. Any type of patterns is undesirable for they will be distracting to the occupants.

### Source/ Task/ Eye Geometry- Very Important

- Luminaires should be kept away from the offending zone to reduce reflections. Indirect lighting and luminaires placed to the sides of the desks will help avoid these problems.

#### Appearance of Space and Luminaires- Important

- It is important that the space be bright and uniformly illuminated to avoid visual distractions and clutter. Areas of circulation should stand out in order to guide foot traffic.

#### Color Appearance (and Color Contrast) - Important

- Color appearance can affect visibility and aesthetics. Proper color rendering is crucial for producing a pleasant looking space and complementing the appearance of the occupants. Contrast is required for distinguishing text in reading applications.

#### Daylighting Integration and Controls- Important

- Daylighting integration is important for reduction of lighting load and to provide high quality light or light with exceptional color rendering. The space receives an ample amount of natural light due to the fact that about 50 percent of its walls are exterior glazing. However, measures need to be taken to control the amount of daylighting such as shading in order to reduce glare or excessive solar heat gain.

#### Modeling of Faces and or Objects- Important

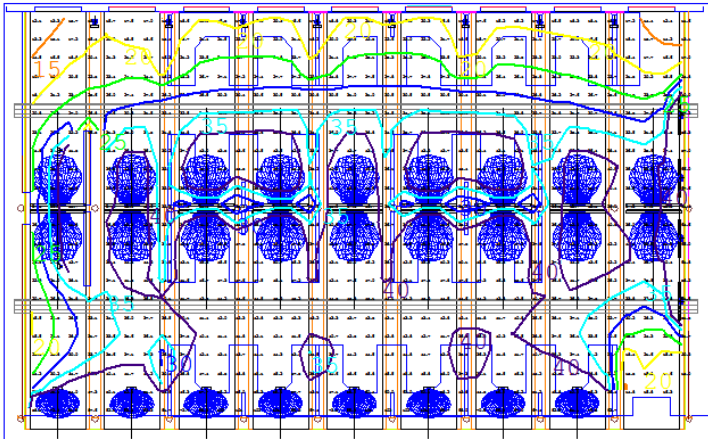
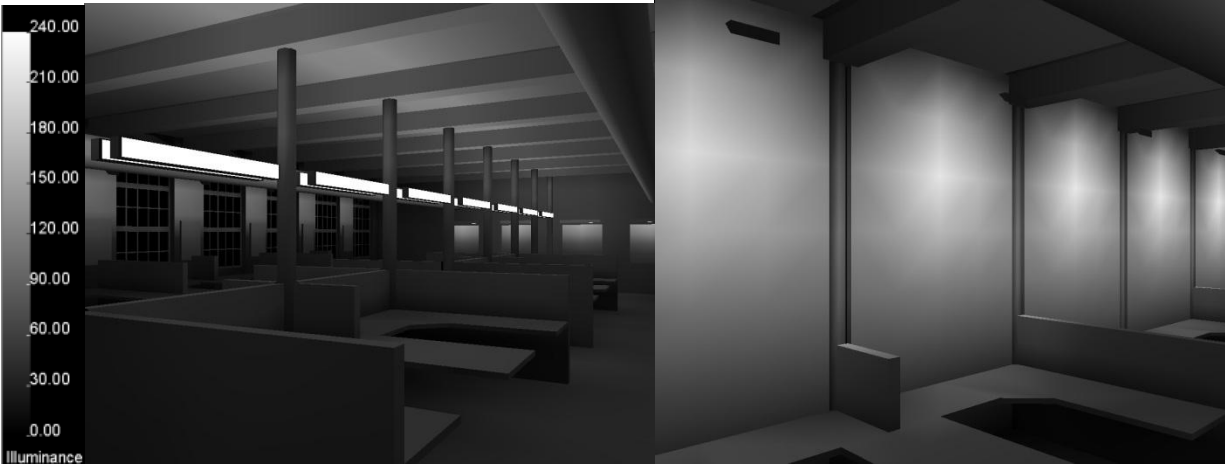
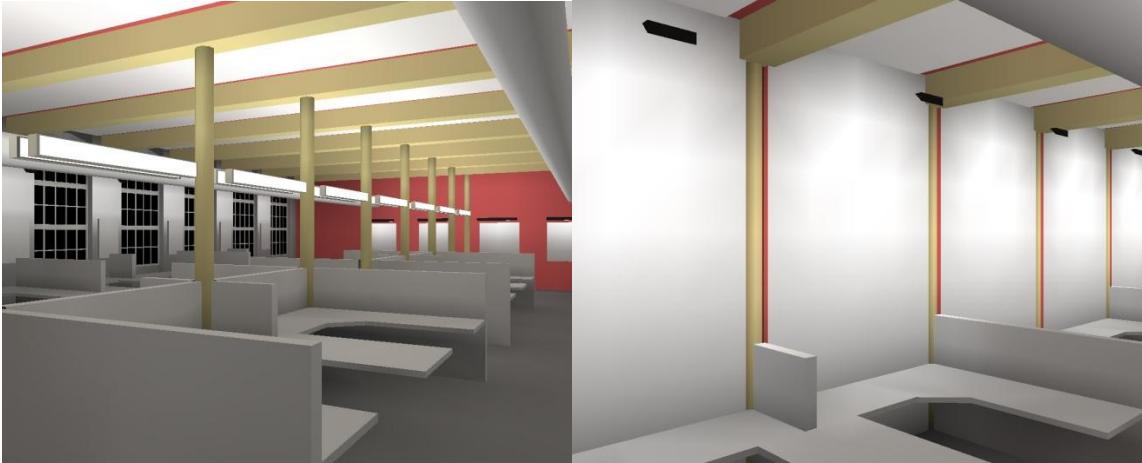
- Within the work environment, it is often important for people to converse with one another and share ideas. Therefore, it is necessary that the occupants' faces are rendered in a pleasant manner in order to optimize social interaction.

#### **Power Allowances and Control Requirements (ASHRAE 90.1):**

ASHRAE 90.1 states that the maximum power density for an office space, using the Space-by-Space Method, is  $1.1\text{W}/\text{ft}^2$ . As for lighting controls, because the building is over  $5000\text{ ft}^2$  "all interior lighting shall be controlled with an automatic control device to shut off building lighting in all spaces."

# Work Space: Evaluation

## AGI32 Analysis



## Work Space: Evaluation

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Based on the computer model and hand calculations, the space does not meet the power density allowance. In fact it is double the allowance. It does however meet the IES recommended illuminance levels. The lighting scheme in the room is completely indirect lighting. This is the sole reason for the outrageous power consumption. Though, with power aside, this design is very well laid out. It addresses all major design criteria. Since the light has to travel a greater distance than direct lighting and bounce off of more surfaces, the efficiency goes down. Conversely, the lighting uniformity increases when light travels a greater distance and bounces off more objects. Consequently, the uniformity in this space is superb. Direct and reflected glare from fixtures are almost non-existent. Any glare from daylight can be controlled by window blinds.

# Special Purpose Space: Existing Conditions

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## **Description:**

This special purpose space is labeled as a training room; however it also can be configured to accommodate a variety of tasks such as staff meetings and presentations. The default configuration is an open layout with tables against the south and east walls which display the Elliptipar product line. A retractable projection screen is housed in the ceiling above the west wall, which is utilized in most assemblies. Though the freight elevator is no longer in use, the original doors have been preserved as a tribute to the history of the building. They are located along the north wall. Since this space is in the center of the building, there is no daylight.

## **Materials:**

### Floor:

Dark blue carpet.

Reflectance: 0.2 (assumed)

### Ceiling:

White acoustical tile.

Reflectance: 0.8 (assumed)

### Walls:

White paint on gypsum wall board.

Reflectance: 0.5 (assumed)

### Furniture:

Tables.

Reflectance: 0.5 (assumed)

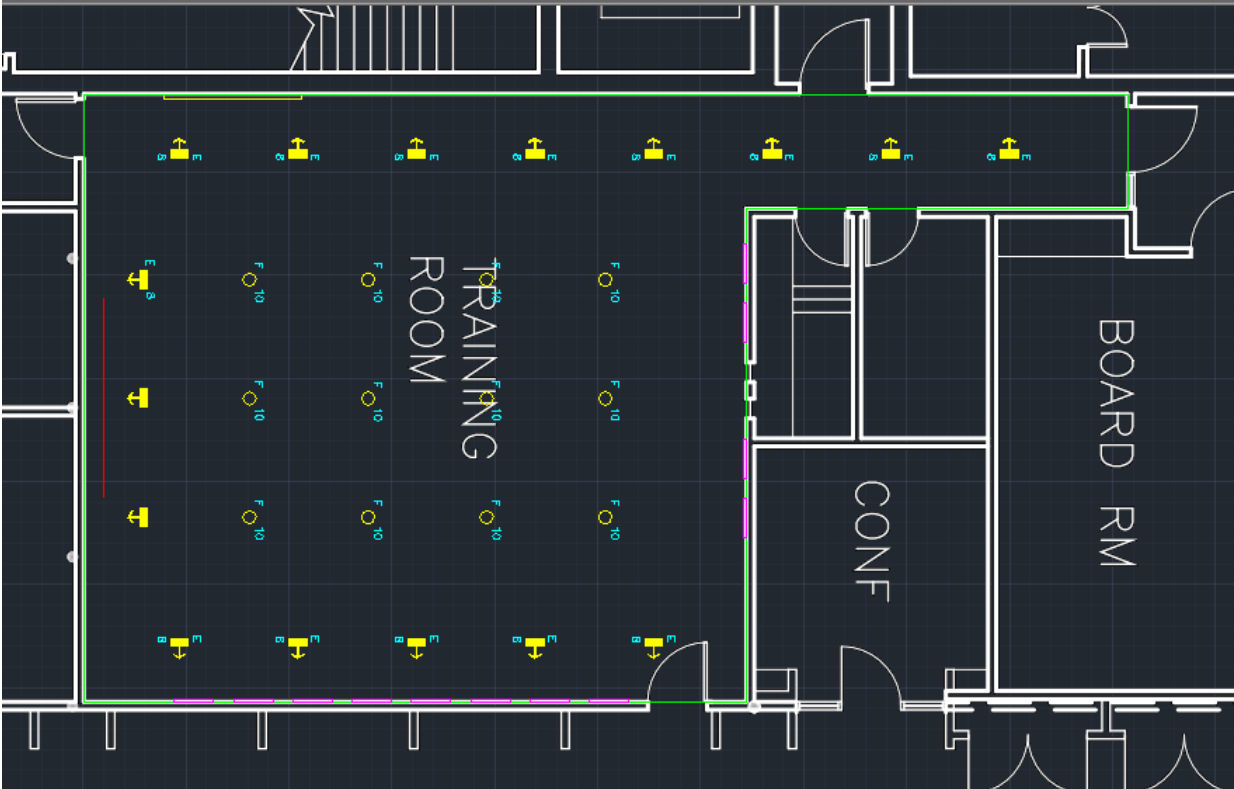
### Elevator doors:

Silver paint over metal doors.

Reflectance: 0.4 (assumed)

# Special Purpose Space: Existing Conditions

Lighting Plan and Photographs:



## Special Purpose Space: Existing Conditions

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### Lighting Equipment:

General ambient light in the special purpose area is provided by recessed Edison Price halogen downlights. The north and south walls are washed with semi-recessed T201 fixtures. The north wall contains the original freight elevator doors, and the south wall contains framed paintings. The dimming controls in the room are programmed to accommodate a variety of lighting needs.

### Schedule:

Lighting	Name	Mounting	Type	Qty.	Lamps Ea.	Watts Ea.	Watts Tot.
Downlight	Edison Price 20/4	Recessed	F	12	1-50W PAR 20	50	600
Wall Wash	Elliptipar T201	Semi-Rec	E	13	1-250W Halogen	207	2691

# Special Purpose Space: Design Consideration

---

## Design Criteria:

### Conference Rooms – Meeting

#### Illuminance Values

- Horizontal - 30 fc
- Vertical - 5 fc

#### Appearance of Space and Luminaires

- IESNA puts great importance on this topic. The interior architecture should speak for itself, yet coincide with the overall theme of the building. The appearance of the luminaires should implement the interior architecture by being simple and not interrupting the task in the space.

#### Color Appearance (and Color Contrast)

- Though not of the highest importance, IESNA still sees color appearance to be moderately important. Color appearance of this space should be welcoming and warm. Proper color rendering is important for complementing skin tones. As in most meeting spaces, there is a projector screen. Contrast is necessary to distinguish text in reading applications.

#### Daylight Integration and Control

- Daylight control is only somewhat important in a meeting space. As is the case, many meeting spaces are in the center of a building with no windows. This is generally preferred because there is no extra ambient light from sunlight to take care of when the room has been dimmed.

#### Direct Glare

- Direct glare is very important. It can result in severe visual discomfort. To avoid direct glare, in a meeting room there is usually a circumstance where the occupants must direct their attention to a particular source for extended periods of time.

#### Light Distribution on Surfaces

- The beam distribution on the walls is important. The correct fixtures should be chosen and aimed properly to minimize undesirable beam spread.

#### Light Distribution on Task Surfaces

- Light distribution on the tables should be as uniform as possible. This is important in completing visual tasks such as reading text on a paper.



#### Modeling of Faces or Objects

- Facial modeling is very important with giving speeches or presentations. Seeing the presenter well aids in the clarity of the presentation. This requires a good combination of direct and indirect light.

#### Shadows

- The speaker's face, for instance, should not be in shadow. Nor should any other visual task. This can be overcome by the proper placement and aiming of fixtures in the space. If a spotlight on a speaker is directly overhead or behind them, they will be in shadow.

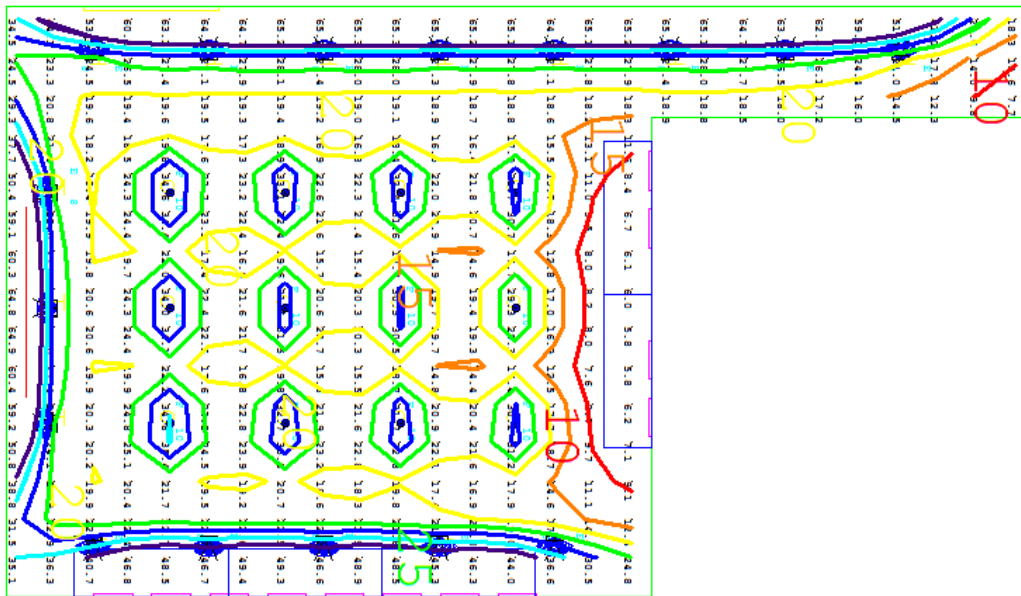
#### Surface Characteristics

- Surface characteristics are important. If a bright room is desired, the surfaces in a room must convey the goal. All wall surfaces in the room are gypsum wall board, painted white. High luminance can easily be achieved.

#### **Power Allowances and Control Requirements (ASHRAE 90.1):**

ASHRAE 90.1 states that the maximum power density for an office space, using the Space-by-Space Method, is  $2.6\text{W}/\text{ft}^2$ . As for lighting controls, because the building is over  $5000\text{ ft}^2$  "all interior lighting shall be controlled with an automatic control device to shut off building lighting in all spaces."

# Special Purpose Space: Evaluation



## Special Purpose Space: Evaluation

---

Based on the computer model and hand calculations, the space does not meet power density requirements. But it is not too far off, at 0.2 W/ft<sup>2</sup> over. If the space was set up slightly differently, it could easily meet the requirement. To do so, the space would need to be less dependent on wall washing. The wall washing in general does not add as much illuminance on the work plane as the downlights. With this said, if the design used several less wall washers and several more downlights, the power density would be met without sacrificing much in the way of the current scheme. The average illuminance is well under the target of 30 fc at 24 fc. The previous solution for reducing power consumption may have a positive effect on the low illuminance as well.

The space does a fairly decent job of addressing direct glare. The downlights are recessed far enough into the ceiling that direct-glare under normal conditions is unlikely. Also the wall washers are provided with internal baffles, that reduces glare. Glare from sunlight is not an issue in this room, as there are no windows. Light is distributed on the walls evenly from the array of wall washers. Also, light distribution in the center of the room, where guests may have gathered, is relatively uniform from the recessed downlights

# Circulation Space: Existing Conditions

---

## **Description:**

This circulation space in study is the main lobby from the parking lot. The entrance door leads in through the east side of the lobby. To its north is a corridor leading to the work space as previously studied. To the west is the special purpose space, as previously described. To the south is a glass curtain wall which leads to the reception area, a product display, and another office cubicle area. A series of large black and white photographs is a focal point of the lobby. Throughout all major circulation space is the preserved original wood factory floor, which has been restored to better than new condition. Along with exposed beams and columns in the work space, the wood work is a defining element of the entire building.

## **Materials:**

### Floor:

Polyurethaned wood

Reflectance: 0.4 (assumed)

### Ceiling:

White acoustical tile.

Reflectance: 0.8 (assumed)

### Woodwork:

Wood columns.

Reflectance: 0.5 (assumed)

### Walls:

White paint on brick.

Reflectance: 0.5 (assumed)

### Partition:

Glass curtain wall.

Reflectance: 0.15 (assumed)

Transmittance: 0.85 (assumed)

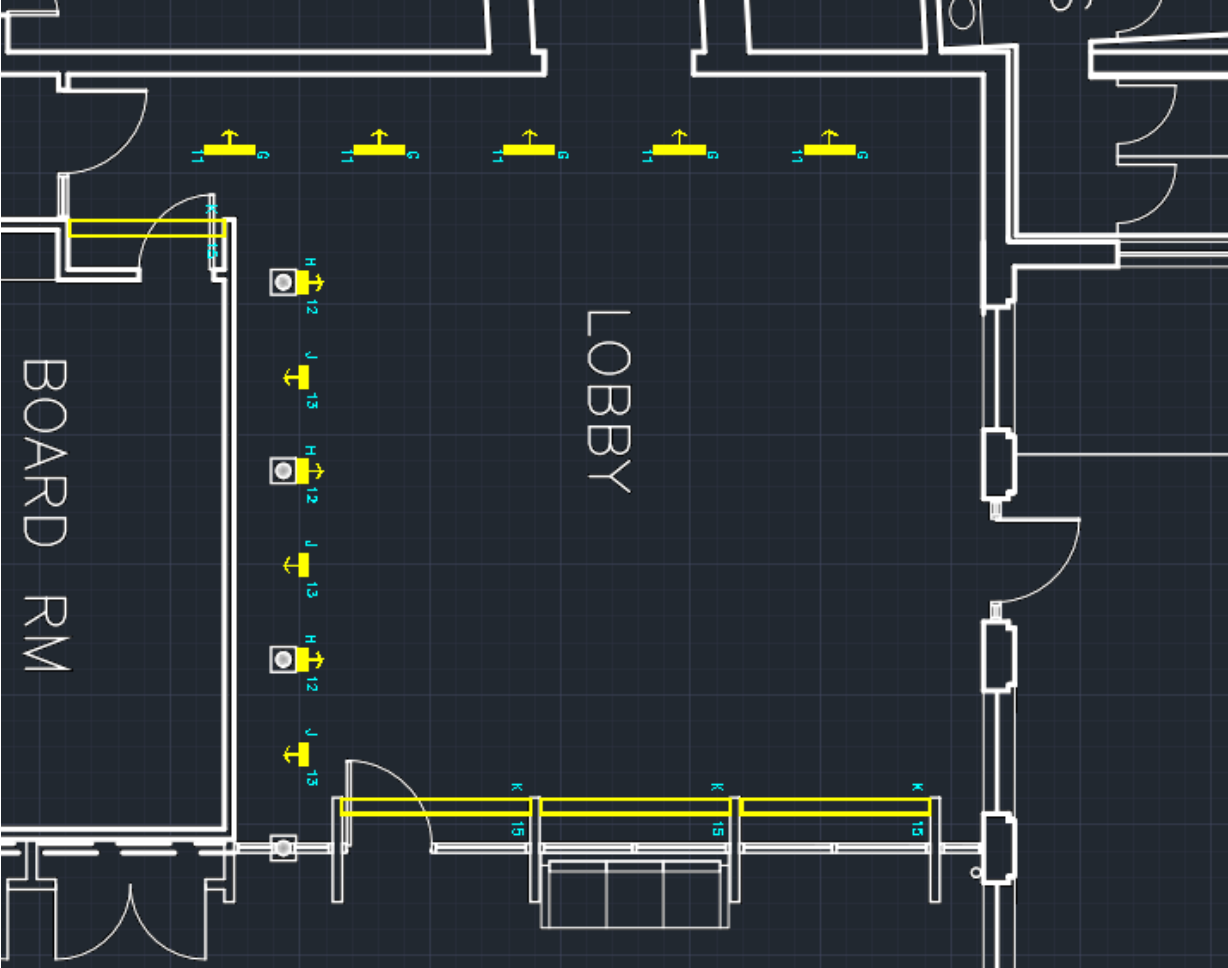
### Wall Hangings:

Pictures.

Reflectance: 0.5 (assumed)

# Circulation Space: Existing Conditions

Lighting Plan and Photographs:



## Circulation Space: Existing Conditions

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### Lighting Equipment:

Since the lobby is only ever in function during daylight hours, there is no official ambient lighting. Instead the light comes primarily from daylight through the large curtain wall on the east side. The daylighting is supplemented by wall washing on the north and west sides, as well as indirect ceiling lighting on the west and south sides.

### Schedule:

Lighting	Name	Mounting	Type	Qty.	Lamps Ea.	Watts Ea.	Watts Tot.
Wall Wash	Elliptipar F209	Semi-Rec	G	5	2-Twin Tube Flu.	110	550
Uplight	Elliptipar M101	Flush Mnt	H	3	1-Ceramic MH	150	450
Wall Wash	Elliptipar M101	Cantilever	J	3	1-Qaud Tube CFL	150	450
Up/Down	Custom	Fixed Mnt	K	4	2-25W T8	50	200

# Circulation Space: Design Consideration

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## Design Criteria:

Offices – Lobbies, lounges, and reception areas

### Illuminance Values

- Horizontal – 10 fc
- Vertical – 3 fc

### Appearance of Space and Luminaires

- IESNA puts great importance on this topic. The interior architecture should speak for itself, yet coincide with the overall theme of the building. The appearance of the luminaires should implement the interior architecture by being simple and not interrupting the task in the space. The lobby is usually the first impression a person will get of the building. It is important that the first impression is a good one. Also, luminaires giving direction to the guests is helpful.

### Color Appearance (and Color Contrast)

- Though not of the highest importance, IESNA still sees color appearance to be moderately important. Color appearance of this space should be welcoming and warm. Proper color rendering is important for complementing skin tones.

### Daylight Integration and Control

- Daylight integration and control is only somewhat important to IESNA in a lobby space. However, since lobbies are generally adjacent to an outdoor space, daylight integration is usually not an issue. The issue of daylight control may not be necessary, as the curtain wall does not suffer from direct sunlight penetration.

### Direct Glare

- Direct glare can cause visual discomfort to a guest. In order to reduce direct glare, luminaires should be placed accordingly so that they minimize direct line of sight. As a compromise, a glare shield can be specified.

### Light Distribution on Surfaces

- The beam distribution on the walls is important. The correct fixtures should be chosen and aimed properly to minimize undesirable beam spread. This is key in the proper illumination of the black and white photographs on the north wall.

### Luminance of Room Surfaces

- Luminance is important in creating a visual hierarchy in the space. Although the large photographs on the north wall are major focal points of the room, the other wall surfaces must not be left out. Luminance on the walls acts as a defining border, but can

also give the sense of spaciousness.

#### Modeling of Faces or Objects

- It is likely that while walking through the lobby, an employee or guest will pass another person. A high percentage of communication is nonverbal. It is important that the pattern of light on faces enables clear recognition and interpretation of expression by enhancing contrast in certain areas around the mouth and eyes.

#### Surface Characteristics

- Dark surfaces, saturated colors, and glossy finishes can maintain visual interest and stimulation, but they should be used to a limited degree. In the lobby the floor is polyurethaned wood, which has a distinct shine to it

#### Psychological Reinforcement

- A psychological impression, or Flynn impression, that would be most fitting to a lobby space is that of spaciousness. This would be achieved by brightly illuminating the walls and ceiling.

#### **Power Allowances and Control Requirements (ASHRAE 90.1):**

For convenience, this space will be considered as a lobby while referencing ASHRAE 90.1.

ASHRAE 90.1 states that the maximum lighting power density for a lobby, if using the Space-by-Space Method, is 1.3 W/ft<sup>2</sup>. As for lighting controls, because the building is over 5000 ft<sup>2</sup> “all interior lighting shall be controlled with an automatic control device to shut off building lighting in all spaces.”



## Circulation Space: Evaluation

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The lobby floor is polyurethaned wood, which has a distinct shine to it. Though it is used far more than sparingly, it does not overpower the space. In fact the wood flooring is one of the most defining features in the entire building. The appearance of the luminaires in the lobby is fair. It gives a good impression of what to expect of the rest of the building before walking through it.

Modeling of faces is exquisite in this space. The daylight entering the large window provides contrast on defining features of a face, and the lighting in the room softens the hard shadows, giving the best of both conditions. Psychologically, this space gives an overall sense of openness. It does so by lighting the walls and ceiling.

Direct glare walking into the lobby from the outside is not as issue, as there are no fixtures whose lamps are in direct sight. The only glare issue may be the morning sun through the large open window, since it does not have any shading.

Overall the lobby is well rounded. It is nothing spectacular as far as lobbies go. But it is very functional and understated. The acoustical tiles take away from the authenticity of the room. The hardwood floors and painted brick walls give a sense of solidity; however the ceiling detracts from that feeling.

# Outdoor Space: Existing Conditions

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## **Description:**

The outdoor space in study is the building façade outside of the lobby area. This façade is part of the main entrance and will be seen by anyone entering the building through the lobby. At night the walls are washed with metal halide fixtures.

## **Materials:**

Walls:

Red Brick

Reflectance: 0.3 (assumed)

Windows:

Double Pane Glass

Reflectance: 0.15

Transmittance: 0.85

Sidewalk:

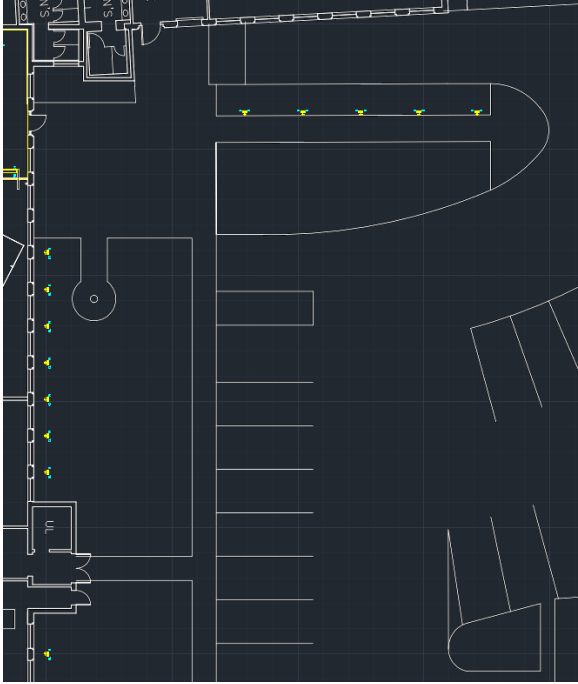
Concrete:

Reflectance: 0.3 (assumed)

# Outdoor Space: Existing Conditions

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## Lighting Plan and Photographs:



# Outdoor Space: Existing Conditions

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**Lighting Equipment:**

For obvious reasons, the outdoor space is only ever illuminated at night. Also at night the gates to the property are locked, however the façade in study is still partially viewable from the street. The façade lighting is done primarily by metal halide M159 fixtures. The sidewalk is illuminated by an array of low mounted F152 fixtures

**Schedule:**

Lighting	Name	Mounting	Type	Qty.	Lamps Ea.	Watts Ea.	Watts Tot.
Wall Wash	Elliptipar M159	Yolk	M	7	1-Ceramic MH	70	490
Downlight	Elliptipar F152	Yolk	N	5	1-Hex Tube CFL	32	160

# Outdoor Space: Design Consideration

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## Design Criteria:

Building Exteriors – Entrances – Active (pedestrian/ conveyance)

### Illuminance Values

- Horizontal – 5 fc
- Vertical – 3 fc

### Appearance of Space and Luminaires

- The appearance of the luminaires should implement the exterior architecture by being simple and not interrupting the task in the space. In the case of the building façade and sidewalk, the fixtures should not be obvious.

### Color Appearance

- Color rendering in dimly lit situations becomes increasingly more difficult. A lamp with a high CRI value and low CCT value should be chosen.

### Direct Glare

- Use of cut off optics or semi-cutoff optics can control glare. Avoid using luminaires where the bare lamp can be seen.

### Light Pollution/Trespass

- Avoid using luminaires that emit light above the horizontal plane. Minimize direct light onto nearby windows and illumination onto adjacent properties.

### Modeling of Faces or Objects

- If it is important to identify faces, provide adequate vertical and horizontal illuminance. Diffuse illumination from luminaires and from surface reflection is helpful.

### Points of Interest

- Make sure signs, special landscaping, and other points of interest are clearly visible to attract attention.

## **Power Allowances and Control Requirements (ASHRAE 90.1):**

According to ASHRAE 90.1, power densities for plaza areas shall not exceed 0.2 W/ft<sup>2</sup>.

Walkways less than 10 ft wide shall not exceed a power density of 1.0 W/linear foot.

Walkways greater than 10 ft wide shall not have a power density exceeding 0.2 W/ft<sup>2</sup>.

Lighting for all exterior applications shall have automatic controls capable of turning off exterior lighting when sufficient daylight is available or when the lighting is not required during nighttime hours.

# Outdoor Space: Evaluation

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The luminaires are as out of sight as they could possibly be. The façade lighting is behind a row of bushes, and the sidewalk lighting is hidden within a row of bushes. Direct glare is not an issue, as the sidewalk lighting is mounted at 30" from the ground. An issue may arise with urban sky glow since the façade lighting is mounted on the ground and washes up the wall. The power density for the sidewalk is double that of what is allowed by ASHRAE.

# Appendix

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Light Loss Factor						
Name	Type	LLD	LDD	BF	Total LLF	
Elliptipar F113	A	0.95	0.95	1	0.9025	
Elliptipar M101	B	0.95	0.95	1	0.9025	
Elliptipar F111	C	0.95	0.95	1	0.9025	
Elliptipar T099	D	0.95	0.95	1	0.9025	
Elliptipar F101	L4	0.95	0.95	1	0.9025	

Power Density			
Space	ASHRAE 90.1	Actual	Difference
Work Space	1.1 W/ft <sup>2</sup>	2.2 W/ft <sup>2</sup>	1.1 W/ft <sup>2</sup>
Special Purpose	2.6 W/ft <sup>2</sup>	2.8 W/ft <sup>2</sup>	0.2 W/ft <sup>2</sup>
Circulation	1.3 W/ft <sup>2</sup>	1.7 W/ft <sup>2</sup>	0.4 W/ft <sup>2</sup>
Outdoor Space	1 W/ft	2 W/ft	1 W/ft

**AGI File Location:**

**P:\AE481w\Technical Report 1 AGI Files**